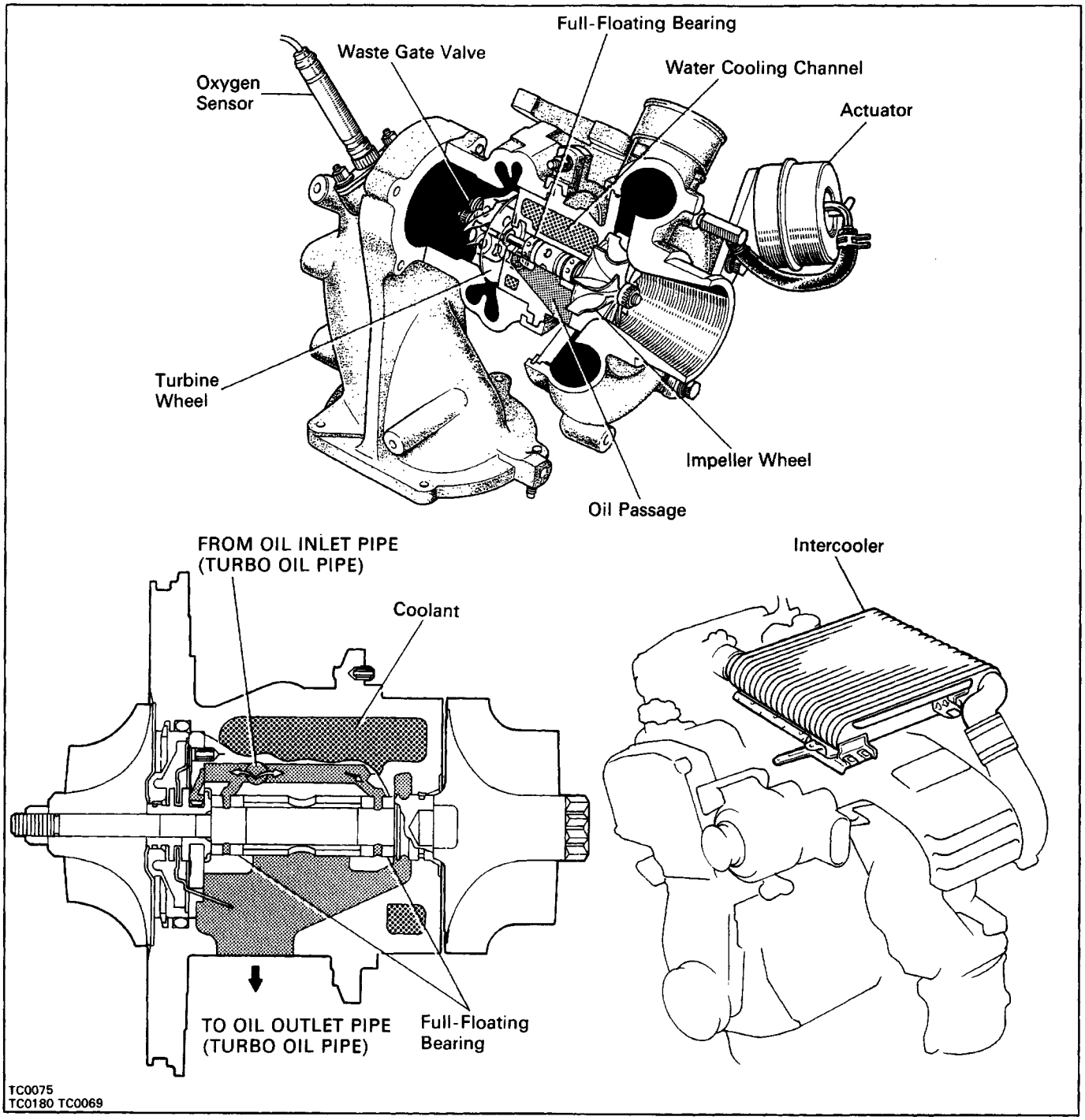
TURBOCHARGER

DESCRIPTION



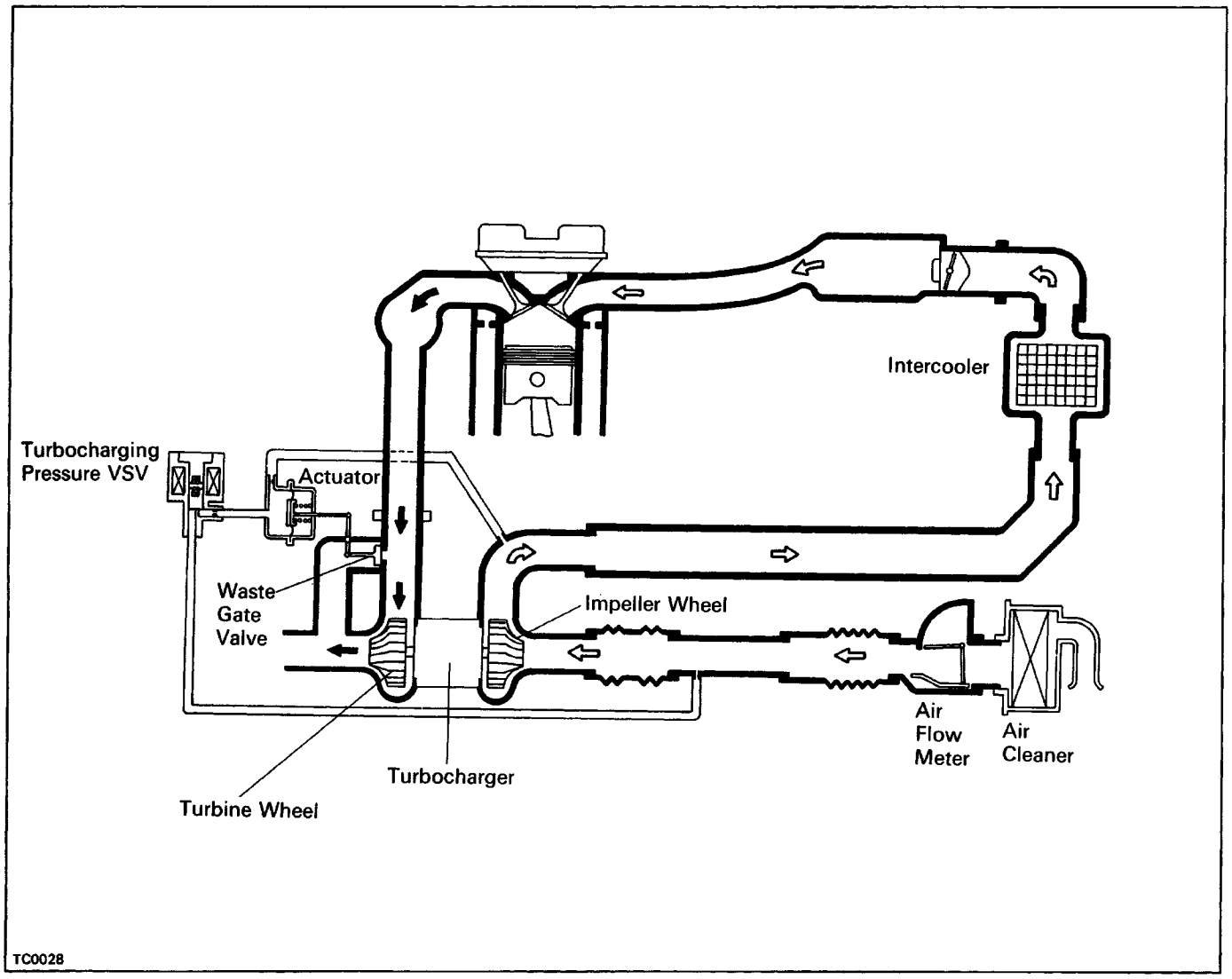
Systems which increase the amount of air sent to the engine are either turbocharger type (using exhaust gas to turn the turbine) or supercharger type (using the engine crankshaft, etc. to mechanically turn the pump, etc.). For CELICA 3S–GTE engine, the turbocharger type has been adopted.

The turbocharger is a device which increases engine output by sending a greater amount of air–fuel mixture to the engine than under normal conditions.

Engine output depends upon the volume of the air–fuel mixture ignited per unit of time.

Therefore, to increase engine output, the most effective method is to send a greater amount of air–fuel mixture into the cylinder.

In other words, by installing a special turbocharger and providing a higher air–fuel mixture than usual, engine output can be increased by increasing the average combustion pressure without increasing the engine speed.



Operation of Turbocharger

Exhaust gas acts on the turbine wheel inside the turbine housing, causing it to revolve. When the turbine Wheel revolves, the impeller wheel which is located on the same shaft also revolves, compressing the intake air which has passed through the air flow meter from the air cleaner. When expelled from the compressor housing, the compressed air is supplied to the cylinders. When the engine speed increases, the exhaust gas volume increases and the turbine wheel revolutions increase (approx. 20,000 –110,000 rpm), thus the turbocharged air pressure grows greater and engine output increases.

Waste Gate Valve

High output is achieved by turbo–charging, but if the turbocharged air pressure becomes too high, knocking occurs and, on the contrary, a reduction in engine output is caused. If the turbocharged air pressure exceeds the prescribed air pressure, the flow of exhaust gas by–passes the turbine, controlling turbine wheel revolutions and turbocharged air pressure. This by–pass valve which controls the quantity of exhaust gas flowing to the turbine is called the waste gate valve. When the turbocharged air pressure exceeds the prescribed pressure, the actuator operates, the waste gate valve opens and part of the exhaust gas by–passes the turbine. This causes a drop in the turbine revolution rate and controls the turbocharged air within the prescribed limits.

Intercooler

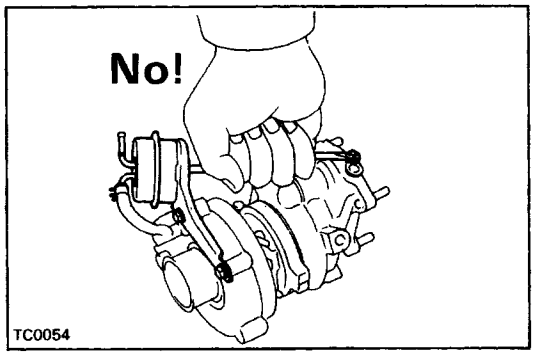
The intercooler cools the turbocharged air (intake air) put out by the turbocharger, thereby increasing the air density. As the intake air temperature decreases, the gas temperature in the combustion chambers falls and the occurrence of knocking is suppressed, giving and increase in engine output.

The Celica 3S–GTE intercooler is an air cooling type located at the top of the engine, utilizing the vehicle windstream to cool turbocharged air.

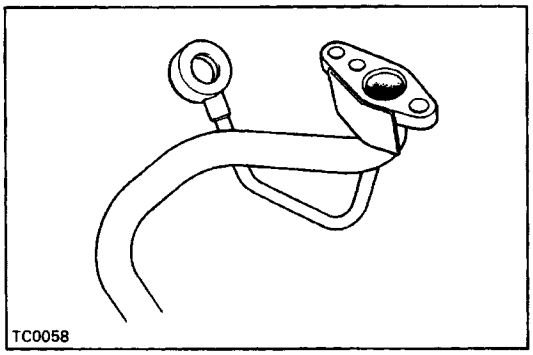
PRECAUTIONS

1. Do not stop the engine immediately after pulling a trailer or high speed or uphill driving. Idle the engine for 20 –120 seconds, depending on the severity of the driving condition.
2. Avoid sudden racing or acceleration immediately after starting a cold engine.
3. If the engine is running with the air cleaner removed, entry of foreign material will damage the wheels which run at extremely high speed.
4. If the turbocharger is defective and must be replaced, first check for the cause of the defect in reference to the following items and replace parts if necessary:

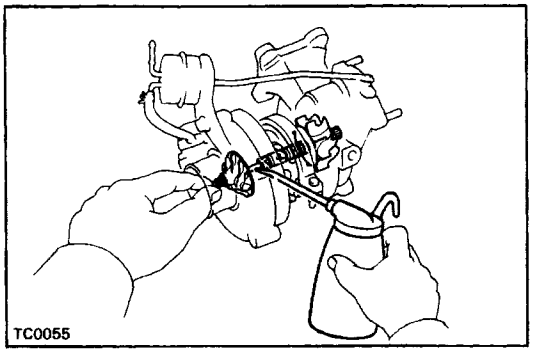
- **Engine oil level and quality**
- **Conditions under which the turbocharger was used**
- **Oil lines leading to the turbocharger**



5. Use caution when removing and reinstalling the turbocharger assembly. Do not drop it or bang it against anything or grasp it by easily–deformed parts, such as the actuator or rod, when moving it.
6. Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign material.



7. If replacing the turbocharger, check for accumulation of sludge particles in the oil pipes, and if necessary, replace the oil pipes.
8. Completely remove the gasket adhered to the lubrication oil pipe flange and turbocharger oil flange.
9. If replacing bolts or nuts, do so only with the specified new ones to guard against breakage or deformation.



10. If replacing the turbocharger, put 20 cc (1.2 cu in.) of oil into the turbocharger oil inlet and turn the impeller wheel by hand to spread oil to the bearing.
11. If overhauling or replacing the engine, cut the fuel supply after reassembly and crank the engine for 30 seconds to distribute oil throughout the engine. Then allow the engine to idle for 60 seconds.

TROUBLESHOOTING

HINT: Before troubleshooting the turbocharger, first check the engine itself. (Valve clearance, engine compression, ignition timing etc.)

INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION

(Possible. Cause)	(Check Procedure and Correction Method)
1. TURBOCHARGING PRESSURE TOO LOW	Check turbocharging pressure. (See page TC–8) **Turbocharging pressure:** **49 – 81 kPa** **(0.50 – 0.83 kgf/cm^2, 7.1 – 11.8 psi)** If the pressure is below specification, begin diagnosis from item 2.
2. RESTRICTED INTAKE AIR SYSTEM	Check intake air system, and repair or replace parts as necessary. (See page TC–9)
3. LEAK IN INTAKE AIR SYSTEM	Check intake air system, and repair or replace parts as necessary. (See page TC–9)
4. RESTRICTED EXHAUST SYSTEM	Check exhaust system, and repair or replace parts as necessary. (See page TC–9)
5. LEAK IN EXHAUST SYSTEM	Check exhaust system, and repair or replace parts as necessary. (See page TC–9)
6. ERRATIC TURBOCHARGER OPERATION	Check rotation of impeller wheel. If it does not turn or turns with a heavy drag, replace the turbocharger assembly. Check axial and radial plays of impeller wheel. (See page TC–13) **Axial play: 0.13 mm (0.0051 in.) or less** **Radial play: 0.18 mm (0.0071 in.) or less** If not within specification, replace the turbocharger assembly.

ABNORMAL NOISE

(Possible Cause)	(Check Procedure and Correction Method)
1. TURBOCHARGER HEAT INSULATOR RESONANCE	Check for loose, improperly installed or deformed insulator mounting bolts, and repair or replace as necessary.
2. EXHAUST PIPE LEAKING OR VIBRATING	Check for deformed exhaust pipe, loose mounting bolts or damaged gasket, and repair or replace as necessary.
3. ERRATIC TURBOCHARGER OPERATION	Refer to Item 6 of INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION.

EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST

(Possible Cause)	(Check Procedure and Correction Method)
FAULTY TURBOCHARGER SEAL	Check for oil leakage in exhaust system. • Remove the turbine elbow from the turbocharger and check for excessive carbon deposits on the turbine wheel. Excessive carbon deposits indicate a faulty turbocharger. Check for oil leakage in intake air system. • Check for axial and radial plays in impeller wheel, and replace the turbocharger if necessary. (See page TC–13) **Axial play: 0.13 mm (0.0051 in.) or less** **Radial play: 0.18 mm (0.0071 in.) or less** **NOTICE: There is some oil mist from the PCV in the blowby gas so care must be taken not to diagnose this as an oil leakage from the turbocharger.**

TURBOCHARGER

ON–VEHICLE INSPECTION

1. INSPECT INTAKE AIR SYSTEM

Check for leakage or clogging between the air cleaner and turbocharger inlet and between the turbocharger outlet and cylinder head.

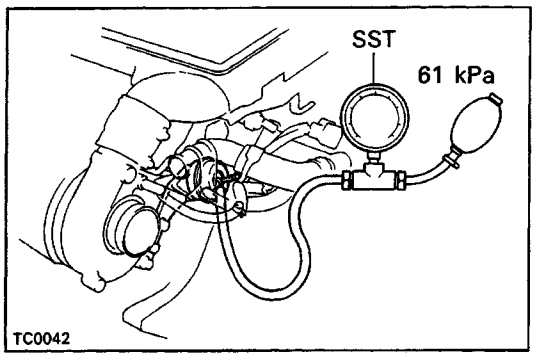
- Clogged air cleaner ..... Clean or replace element
- Hoses collapsed or deformed ..... Repair or replace
- Leakage from connections ..... Check each connection and repair
- Cracks in components ..... Check and replace

2. INSPECT EXHAUST SYSTEM

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbocharger outlet and exhaust pipe.

- Deformed components ..... Repair or replace
- Foreign material in passages ..... Remove
- Leakage from components ..... Repair or replace
- Cracks in components ..... Check and replace

3. INSPECT ACTUATOR OPERATION

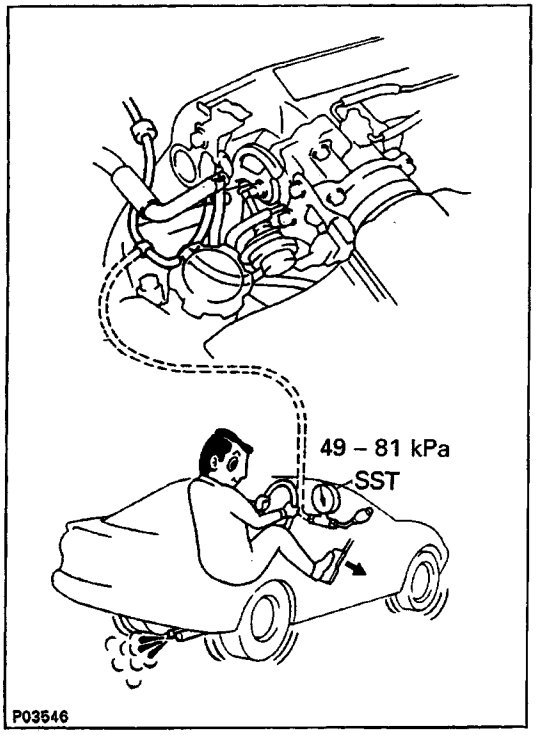


(a) Disconnect the actuator hose.

(b) Using SST (turbocharger pressure gauge), apply approx. 61 kPa (0.62 kgf/cm^2, 88 psi) of pressure to the actuator and check that the rod moves.
If the rod does not move, replace the turbocharger assembly.
SST 09992–00241

NOTICE: Never apply more than 81 kPa (0.83 kgf/cm^2, 11.8 psi) of pressure to the actuator.

4. CHECK TURBOCHARGING PRESSURE



(a) Using a 3–way connector, connect SST (turbocharger pressure gauge) to the hose between the intake manifold and turbocharging pressure sensor.
SST 09992–00241

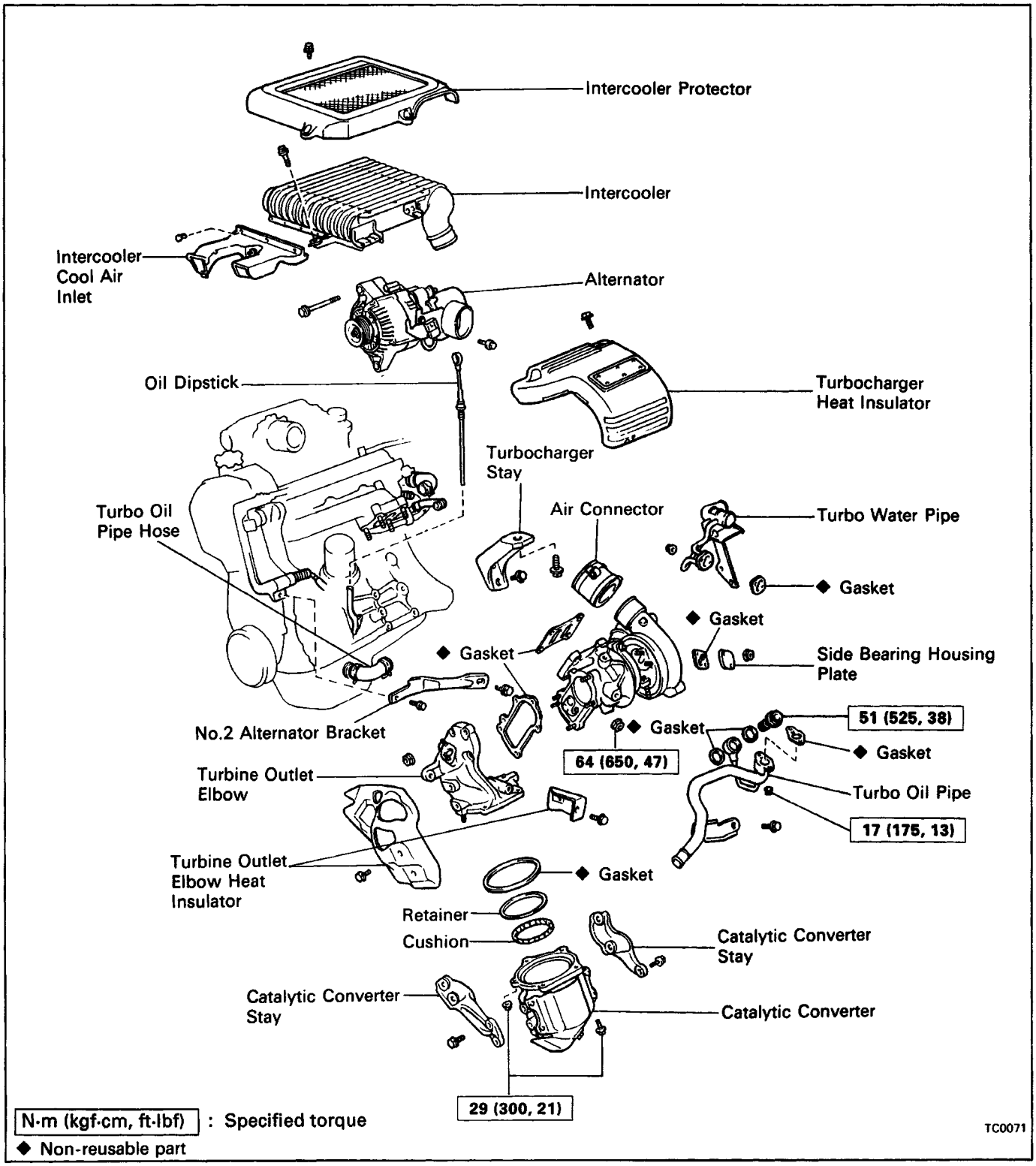
(b) While driving with the engine running at 2,800 rpm or more with the throttle valve fully open in the 2nd gear, check the turbocharging pressure.
Standard pressure: 49 – 81 kPa
(0.50 – 0.83 kgf/cm^2, 7.1 – 17.8 psi)

If the pressure is less than that specified, check the intake air and exhaust systems for leakage. If there is no leakage, replace the turbocharger assembly.

If the pressure is above specification, check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.

5. INSPECT IMPELLER WHEEL ROTATION
(See step 1 on page TC–13)
6. INSPECT TURBOCHARGING PRESSURE VSV
(See page FI–226)
7. INSPECT TURBOCHARGING PRESSURE SENSOR
(See page FI–235)

COMPONENTS



REMOVAL OF TURBOCHARGER

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. REMOVE ENGINE UNDER COVERS

3. DRAIN ENGINE COOLANT (See page CO–6)

4. REMOVE AIR CLEANER CAP
(See step 7 on page EM–224)

5. REMOVE SUSPENSION LOWER CROSSMEMBER
(See step 33 on page EM–228)

6. REMOVE FRONT EXHAUST PIPE
(See step 34 on page EM–229)

7. REMOVE ENGINE MOUNTING CENTER MEMBER
(See step 42 on page EM–229)

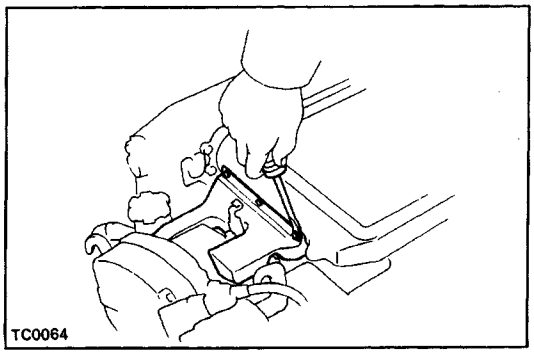
8. REMOVE FRONT MOUNTING INSULATOR AND BRACKET (See step 43 on page EM–230)

9. REMOVE CLUTCH RELEASE CYLINDER WITHOUT DISCONNECTING TUBE
(See step 26 on page EM–227)

10. REMOVE ALTERNATOR (See page CH–7)

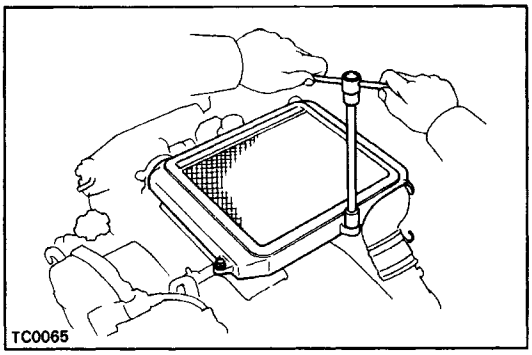
11. REMOVE IDLER PULLEY BRACKET AND A/C COMPRESSOR WITHOUT DISCONNECTING HOSES
(See step 39 on page EM–80)

12. REMOVE CATALYTIC CONVERTER
(See step 45 on page EM–230)



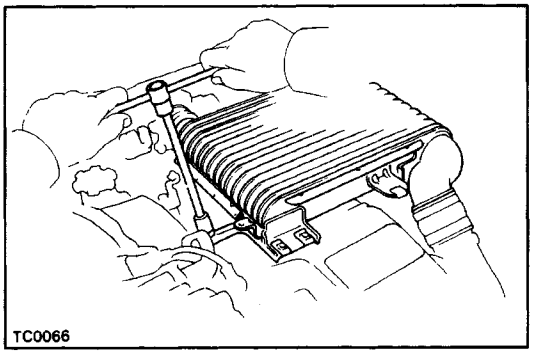
13. REMOVE INTERCOOLER COOL AIR INLET

Using a clip remover, remove the seven clips and air inlet.



14. REMOVE INTERCOOLER PROTECTOR

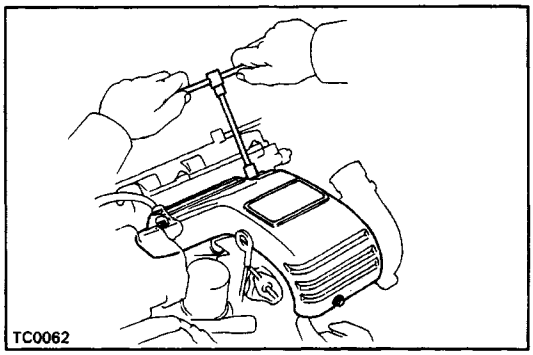
Remove the three bolts and protector.



15. REMOVE INTERCOOLER

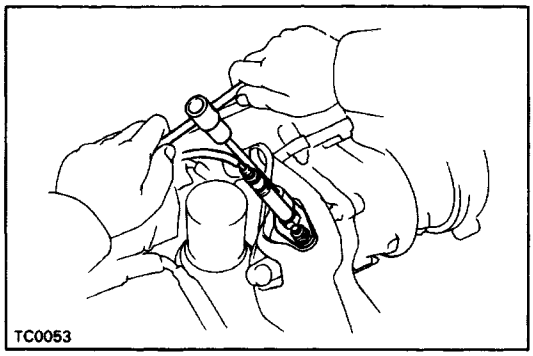
(a) Remove the two bolts.

(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air connector.



16. REMOVE TURBOCHARGER HEAT INSULATOR

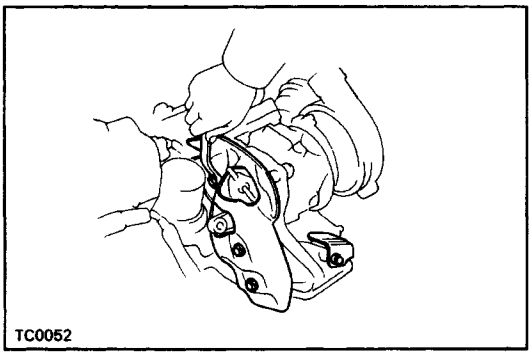
Remove the three bolts and heat insulator.



17. REMOVE OXYGEN SENSOR

(a) Disconnect the oxygen sensor connector.

(b) Remove the two nuts, oxygen sensor and gasket.

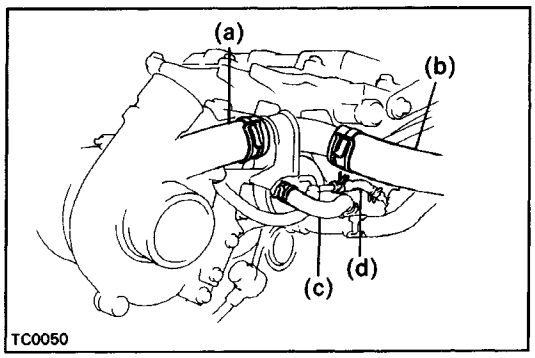


18. REMOVE HEAT INSULATORS OF TURBINE OUTLET ELBOW

(a) Remove the oil dipstick.

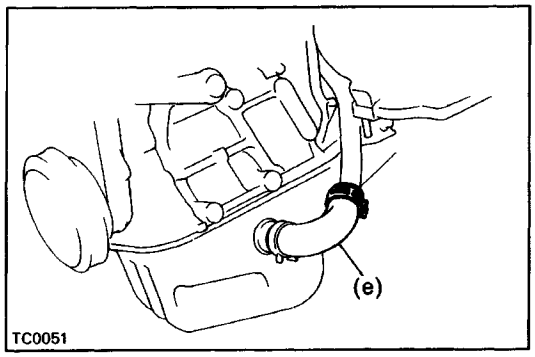
(b) Remove the three bolts and RH heat insulator.

(c) Remove the two bolts and LH heat insulator.

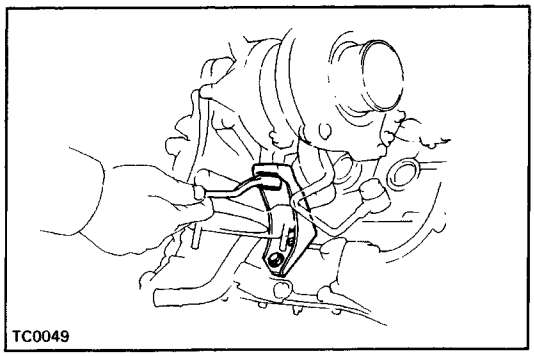


19. DISCONNECT HOSES

(a) Water hose from radiator
(b) Water hose from water inlet
(c) Water by–pass hose from turbo water pipe
(d) Vacuum hose from actuator

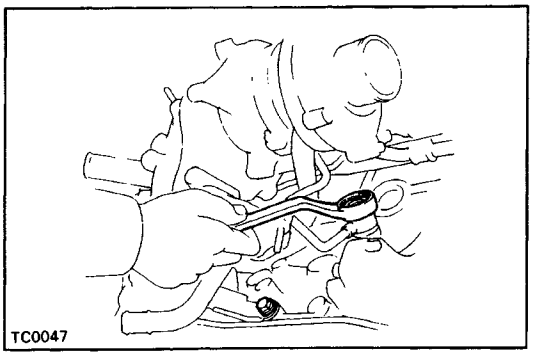


(e) Oil hose from turbo oil pipe



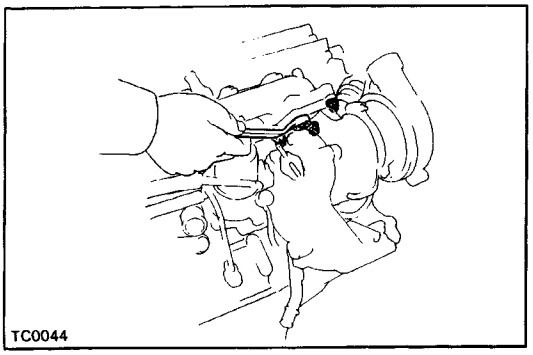
20. REMOVE TURBOCHARGER STAY

Remove the three bolts and turbocharger stay.

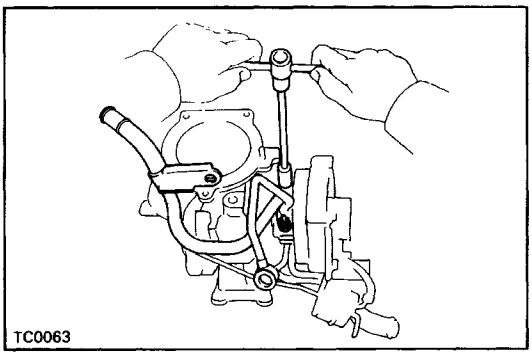


21. REMOVE TURBOCHARGER

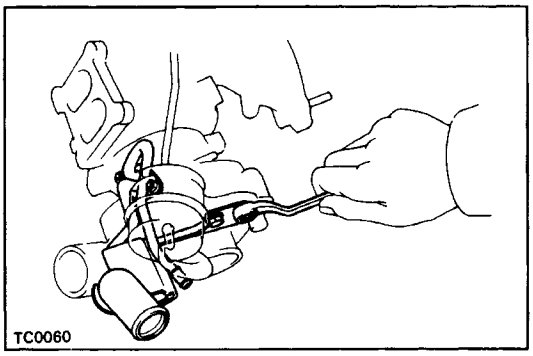
(a) Remove the bolt and union bolt holding the No.1 turbo oil pipe to the cylinder block. Remove the two union bolt gaskets.



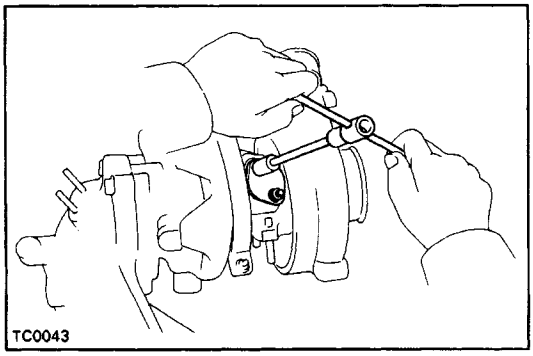
(b) Remove the four nuts, turbocharger and gasket.



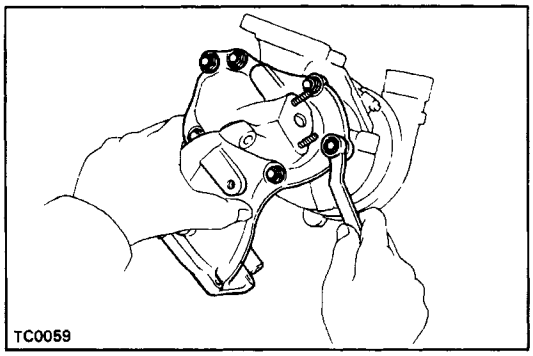
22. REMOVE TURBO OIL PIPE
Remove the two nuts, oil pipe and gasket.



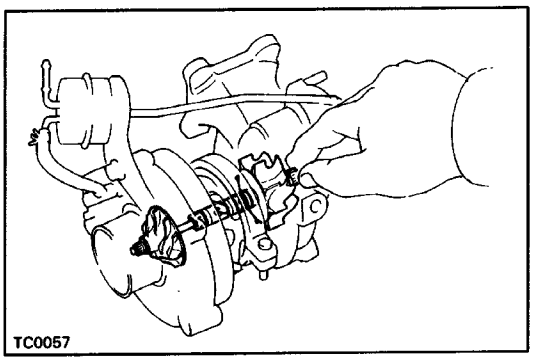
23. REMOVE TURBO WATER PIPE
Remove the two nuts, two bolts, water pipe and gasket.



24. REMOVE SIDE BEARING HOUSING PLATE
Remove the two nuts, housing plate and gasket.



25. REMOVE TURBINE OUTLET ELBOW
Remove the six nuts, outlet elbow and gasket.

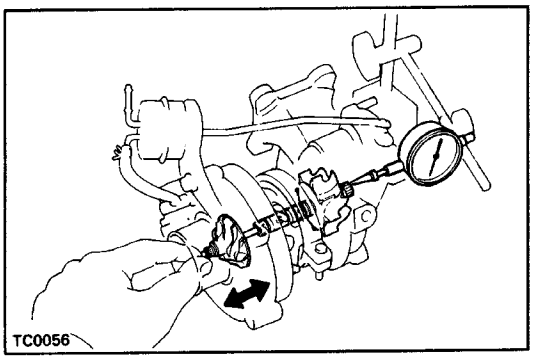


INSPECTION OF TURBOCHARGER

1. INSPECT IMPELLER WHEEL ROTATION

Grasp the edge of the turbine wheel and turn it. Check that the impeller wheel turns smoothly.

If the impeller wheel does not turn or if it turns with a drag, replace the turbocharger assembly.

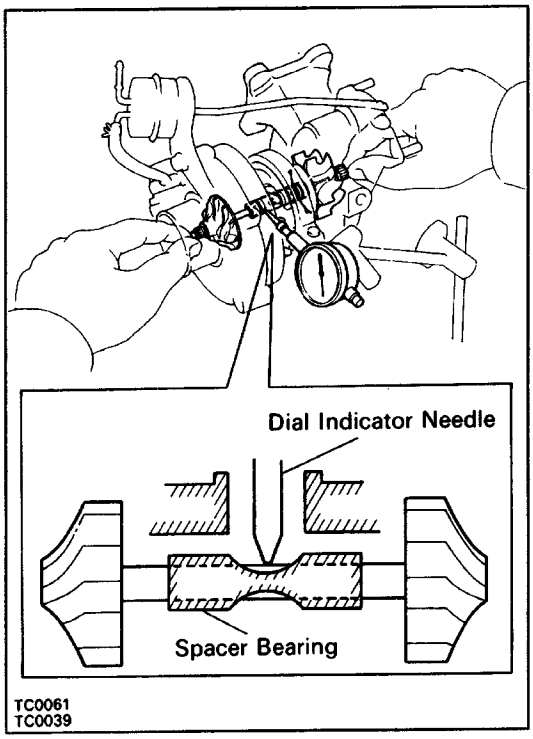


2. INSPECT AXIAL PLAY OF IMPELLER WHEEL

Insert a dial indicator into the intake side, hold the turbine wheel edge by hand, and check the axial play.

Standard clearance: 0.13 mm (0.0051 in.) or less

If the axial play is not as specified, replace the turbocharger assembly.



3. INSPECT RADIAL PLAY OF IMPELLER WHEEL

(a) From oil outlet hole, insert a dial indicator through the hole in the spacer bearing and set it in the center of the impeller shaft.

(b) Move the impeller shaft in a radial direction, and measure the radial play of the impeller shaft.

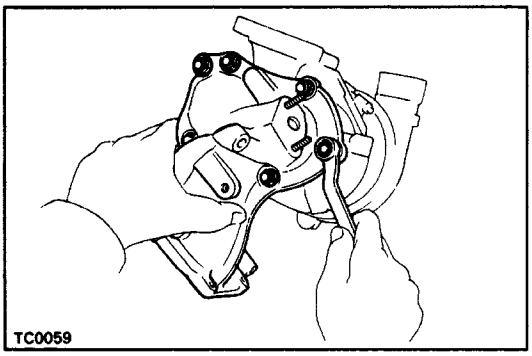
Standard clearance: 0.18 mm (0.0071 in.) or less

If the radial play is not as specified, replace the turbocharger assembly.

INSTALLATION OF TURBOCHARGER

(See page TC–8)

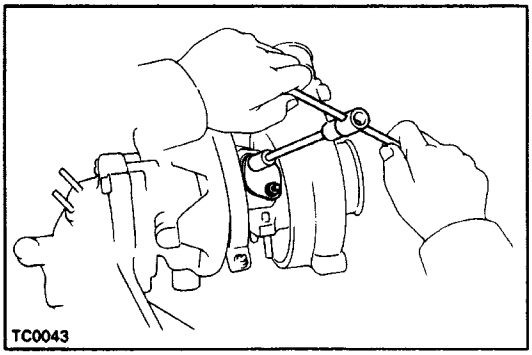
NOTICE: After replacing the turbocharger assembly, pour approx. 20 cc (1.2 cu in.) of new oil into the oil inlet and turn the impeller wheel by hand to splash oil on the bearing.



1. INSTALL TURBINE OUTLET ELBOW

Install a new gasket and the outlet elbow with the six nuts.

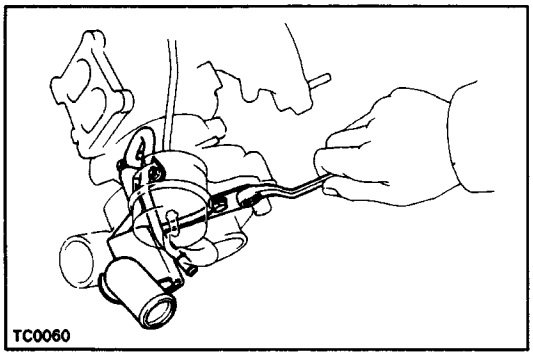
Torque: 64 N–m (650 kgf–cm, 47 ft–lbf)



2. INSTALL SIDE BEARING HOUSING PLATE

Install a new gasket and the housing plate with the two nuts.

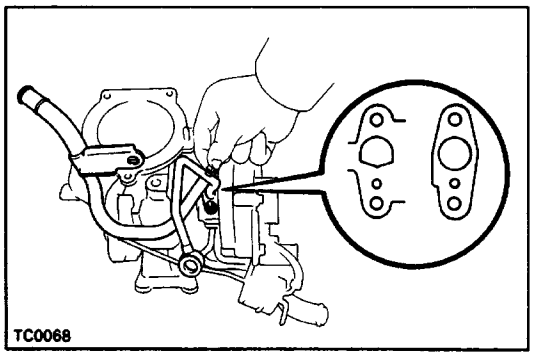
Torque: 11 N–m (120 kgf–cm, 9 ft–lbf)



3. INSTALL TURBO WATER PIPE

Install a new gasket and the water pipe with the two nuts and two bolts.

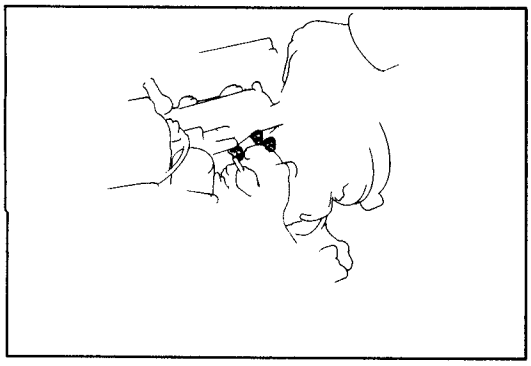
Torque: 11 N–m (120 kgf–cm, 9 ft–lbf)



4. INSTALL TURBO OIL PIPE

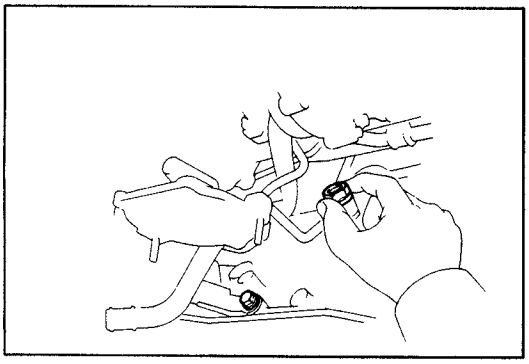
(a) Align the oil holes of a new gasket and the turbocharger housing.

(b) Install the gasket and oil pipe with the two nuts. Do not torque the nuts yet.

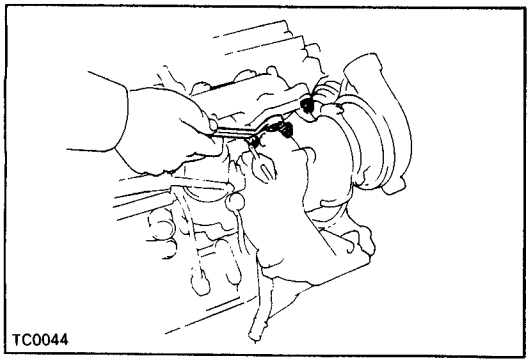


5. INSTALL TURBOCHARGER

(a) install a new gasket and the turbocharger with the four nuts. Do not torque the nuts.

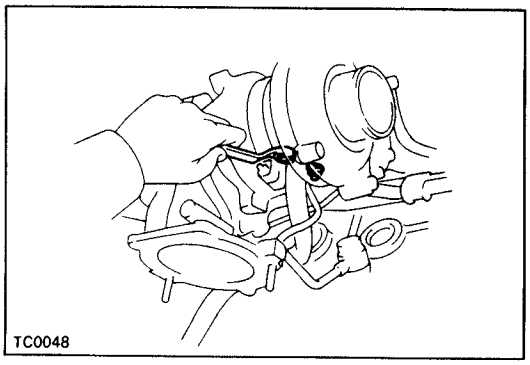


(b) Install the oil pipe with the bolt, two new gaskets and union bolt. Do not torque the bolt and union bolt.



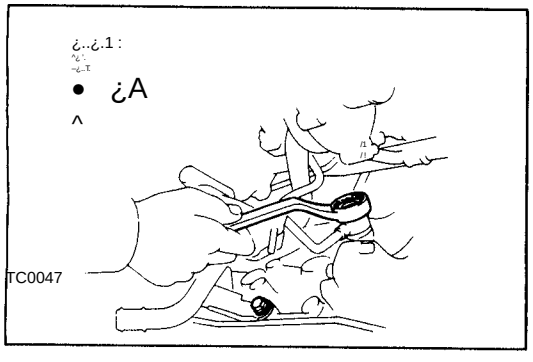
(c) Tighten the four nuts holding the turbocharger to the exhaust manifold.

Torque: 64 N–m (650 kgf–cm, 47 ft–lbf)



(d) Tighten the two nuts holding the oil pipe to the turbocharger.

Torque: 17 N–m (175 kgf–cm, 13 ft–lbf)

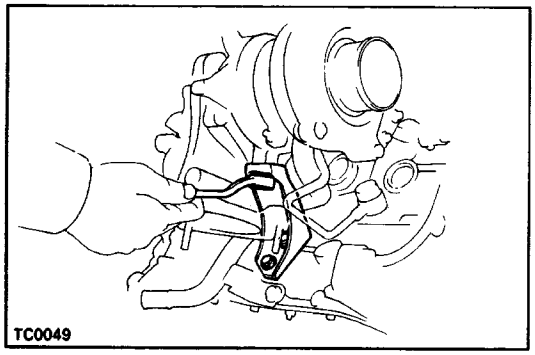


(e) Tighten the union bolt holding the oil pipe to the cylinder block.

Torque: 51 N–m (525 kgf–cm, 38 ft–lbf)

(f) Tighten the bolt holding the bracket of the oil pipe to the cylinder block.

Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)

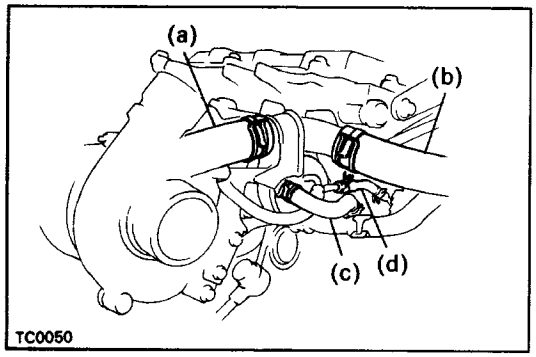


6. INSTALL TURBOCHARGER STAY

Install the turbocharger stay with the three bolts.

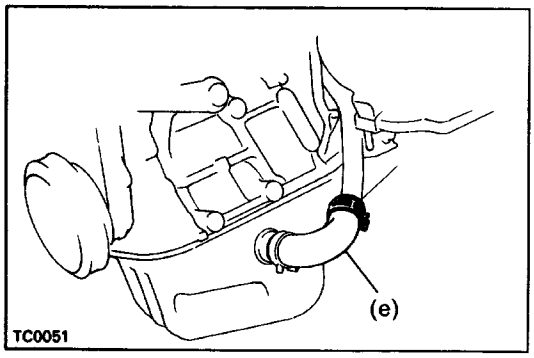
Torque:

To turbocharger
69 N–m (705 kgf–cm, 51 ft–lbf)
To cylinder block
59 N–m (600 kgf–cm, 43 ft–lbf)

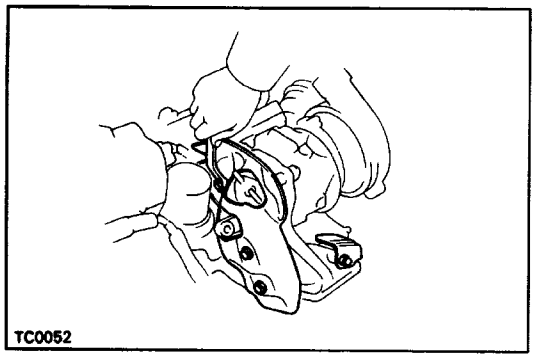


7. CONNECT HOSES

(a) Water hose from radiator
(b) Water hose from water inlet
(c) Water by–pass hose from turbo water pipe
(d) Vacuum hose from actuator

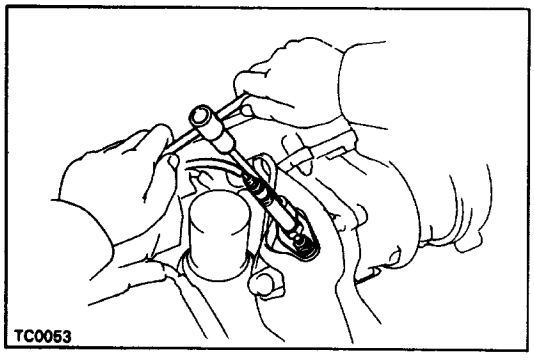


(e) Oil hose from turbo oil pipe



8. INSTALL HEAT INSULATORS OF TURBINE OUTLET ELBOW

(a) Install the RH heat insulator with the three bolts.
(b) Install the LH heat insulator with the two bolts.
(c) Install the oil dipstick gauge.

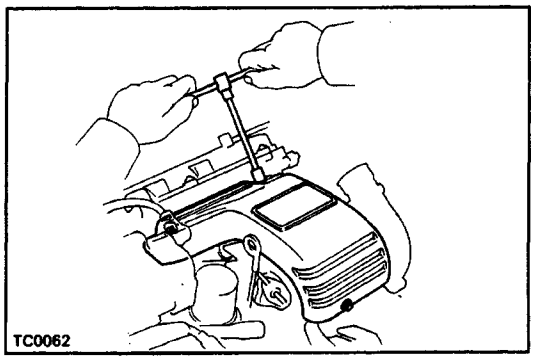


9. INSTALL OXYGEN SENSOR

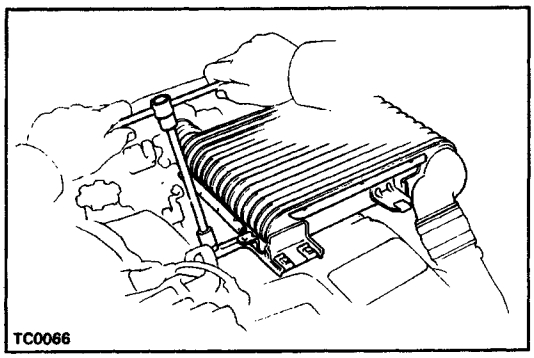
(a) Install a new gasket and the oxygen sensor with the two nuts.

Torque: 44 N–m (450 kgf–cm, 33 ft–lbf)

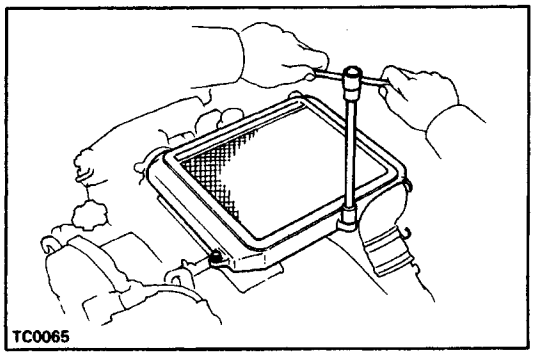
(b) Connect the oxygen sensor connector.



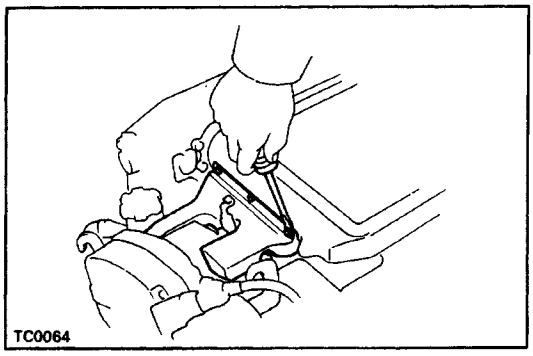
10. INSTALL TURBOCHARGER HEAT INSULATOR
Install the heat insulator with the three bolts.



11. INSTALL INTERCOOLER
Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the two bolts.



12. INSTALL INTERCOOLER PROTECTOR
Install the protector with the three bolts.



13. INSTALL INTERCOOLER COOL AIR INLET
Install the cool air inlet with the seven clips.

14. INSTALL CATALYTIC CONVERTER
(See step 6 on page EM–259)
15. INSTALL A/C COMPRESSOR AND IDLER PULLEY BRACKET (See step 12 on page EM–261)
16. INSTALL ALTERNATOR (See page CH–23)
17. INSTALL CLUTCH RELEASE CYLINDER
(See step 26 on page EM–263)

18. INSTALL FRONT MOUNTING BRACKET AND INSULATOR (See step 7 on page EM–260)
19. INSTALL ENGINE MOUNTING CENTER MEMBER (See steps 9 and 10 on page EM–260)
20. INSTALL FRONT EXHAUST PIPE (See step 18 on page EM–261)
21. INSTALL SUSPENSION LOWER CROSSMEMBER (See step 19 on page EM–262)
22. INSTALL AIR CLEANER CAP (See step 45 on page EM–266)
23. FILL ENGINE WITH COOLANT (See page CO–6)
Capacity (w/ Heater):
6.5 liters (6.9 US qts, 5.7 Imp. qts)
24. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY
25. START ENGINE AND CHECK FOR LEAKS
26. CHECK ENGINE OIL LEVEL (See page LU–5)
27. REMOVE ENGINE UNDER COVERS